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Abstract

Village creek is a lowland stream lying in the Mississippi Embayment in Randolph, Lawrence and Jackson counties in northeastern Arkansas. The stream has been channelized in Randolph and Lawrence counties as have most of its tributaries. The Jackson County portion of the stream has not been channelized. Twelve sites were sampled seasonally by seining along Village Creek and its tributaries. In addition to seasonal work, six sites were sampled from one to three times each by several methods. A total of 8000 specimens was collected by all means used (7754 at seasonal sites and 246 at supplemental sites). Forty-two species were collected from 16 families. Two species not previously reported from the System were collected in this study namely *Hiodon alosoides* and *Pimephales vigilax*. All 42 of the species collected in the study were represented in Jackson County while only 24 species were collected in Lawrence and Randolph counties. Members of the family Centrarchidae were the most commonly collected group (44% of specimens) whereas the most commonly collected species was *Gambusia affinis* (29.6% of specimens). Some of the fish species in the System have shown resilience to stream alteration, domestic sewage, industrial and agricultural runoff and dumping of refuse. However, the future success of some species (e.g., *Opsopoeodus emiliae, Notropis maculatus, Notropis texanus, Lythrurus fumeus, Elassoma zonatum* and *Etheostoma gracile*) will depend on the protection of and sustainable use of the natural resources in the watershed.

Introduction

The Village Creek System lies within the Mississippi Alluvial Plain, as defined by Foti (1974). The alluvial deposition of sand, gravel and clay, which began prior to the Pleistocene, continues today. The soil is deep but almost impermeable, and drainage is poor. Natural vegetation is composed of primarily various bottomland hardwoods, which are adapted to wet, poorly drained soils (Foti, 1974).

Village Creek originates approximately 6 km north of O'Kean in Randolph County and meanders southwesterly through Lawrence County to its confluence with the White River south of Newport in Jackson County. The stream is approximately 88.5 km in length, while the basin's greatest width is 8.2 km (Beadles, 1977). Its watershed lies primarily in Randolph, Lawrence and Jackson counties, but small portions lie within Craighead and Greene counties (Beadles, 1974).

The entire length of Village Creek has been channelized in Randolph and Lawrence counties, as have most of its tributaries. The sparse timber remaining within the watershed occurs as isolated stands along the immediate banks. Some tributaries have been denuded completely. Channelization has been financed and conducted by private landowners, drainage districts and the U.S. Army Corps of Engineers (USACE) (Beadles, 1974). The immediate vicinity of the stream in Jackson County is quite different. Plans to channelize this portion of Village Creek have not been consumated as yet, and fairly extensive tupelo-cypress swamps still remain. In addition to stream channelization, the system has been and continues to be subjected to domestic sewage, chemical runoff (e.g. toxaphene from the 1950's through the 1970's) and industrial effluents, the latter particularly in Jackson and Lawrence counties. These have caused periodic fish kills of varying severity (Beadles, 1977). In this study a spill of diesel fuel was observed in Lawrence County, and a fish kill, which occurred at the St. Hwy. 90 bridge in Randolph County, was probably due to oxygen depletion resulting from a heavy organic load and low water levels.

Black (1940) first surveyed the fishes of Village Creek. He reported 12 species from four sites. The Arkansas Game and Fish Commission (Baker, 1953) has infrequently sampled the sport and commercial fisheries. Beadles (1974, 1977) conducted environmental inventories in which most flora and fauna were evaluated. However, none of these studies examined the stream system comprehensively, and no seasonal data were gathered. Further, continued environmental alteration may have impacted the previously documented status of some fish species within the system.

The primary goal of this study was to establish a current species list for the Village Creek System. Secondary goals were to determine the relative abundance and spatial and seasonal distribution of those species.

Methods and Materials

Twelve sites were selected for seasonal collections on the main stem and tributaries (Fig. 1). They were chosen in many instances because they had served as sites for previ-

ous studies (Beadles, 1974, 1977 and Looney, unpub.). A description of the sites is as follows:

1. Randolph Co. T18N R2E S27&28 (section line). Approx. 3.2 km NW of O'Kean. Trib.
2. Lawrence Co. T17N R1E S5. Village Creek approx. 3.2 km NE of Walnut Ridge.
3. Lawrence Co. T16N R1E S5. Village Creek 0.8 km W of Hoxie on U.S. 63 and below confluence of Coon Creek.
4. Lawrence Co. T15N RIW S1. Village Creek at the St. Hwy. 228 crossing at the westernmost city limits of Minturn.
5. Lawrence Co. T15N R1W S34. Village Creek at the St. Hwy. 230 crossing approx. 0.8 km E of Alicia.
6. Jackson Co. T13N R1W S31. Guffy (Guthrie) Lake on Village Creek 4.8 km E of Tuckerman on St. Hwy. 37.
7. Jackson Co. T11N R2W S7. Village Creek at the St. Hwy. 14 crossing approx. 0.8 km SE of Newport.
8. Lawrence Co. T17N R1E S22&23. Coon Creek approx. 1.6 km N of Walnut Ridge on U.S. 67.
9. Lawrence Co. T16N R1E S15. White Oak Slough approx. 1.6 km SE of Hoxie.
10. Lawrence Co. T15N R1E S12. Lick Pond Slough approx. 8 km ESE of Minturn and 1.6 km N of Jct. of St. Hwys. 91 and 228.
11. Jackson Co. T13N R3W S36. Hout Ditch approx. 4.8 km W of Tuckerman on St. Hwy. 226 then approx. 0.6 km S.
12. Jackson Co. T12N R2E S33. Locust Creek at the Newport Industrial Park (Newport Airbase).

Forty-two of the anticipated 48 samples were obtained. Sites 2, 3 and 4 were not sampled during the fall, and sites 7, 11 and 12 were not sampled during the winter because of high water. Some channelized sites were virtually impossible to seine during periods of high water because of water depth and current velocity.

Seasonal samples were obtained by use of two seines. The seines were 6 m x 2 m with 3 mm mesh and 15 m x 1.2 m with 6 mm mesh and both seines were constructed with delta type netting. Attempts were made to seine one man-hour at each site per season. At some sites this was enough time to sample all of the specimens for a considerable distance, especially when low-water conditions existed.

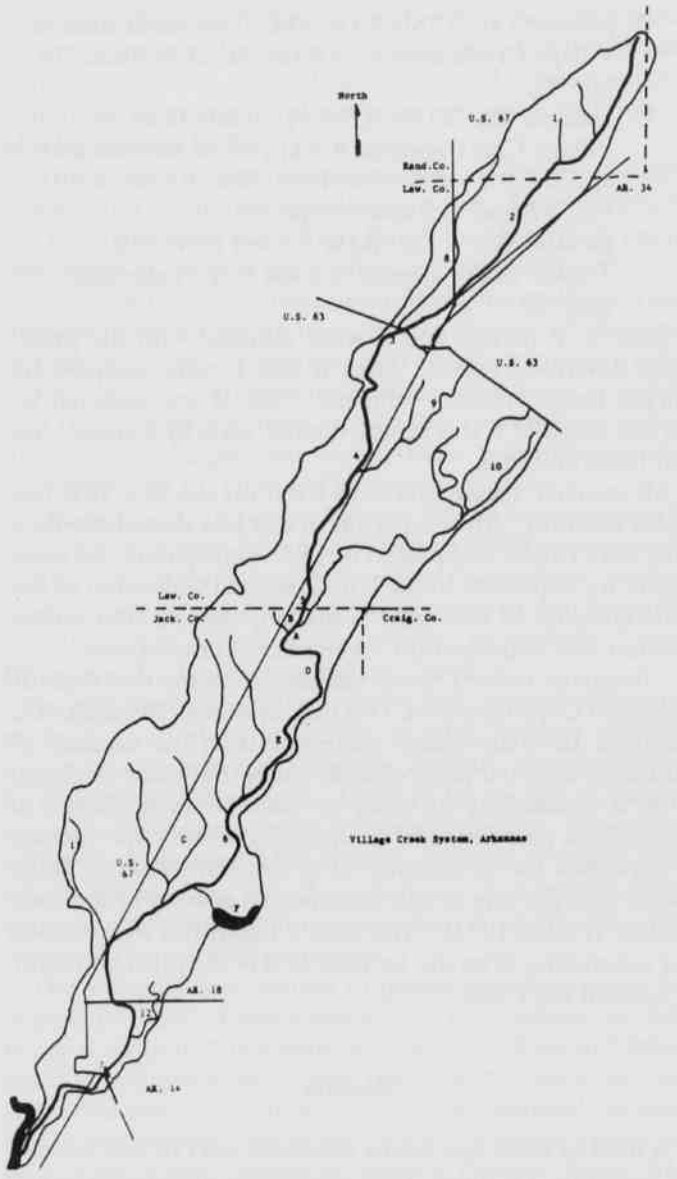

Fig. 1. The Village Creek System.

In addition to the seasonal sites, six supplemental sites were selected to more thoroughly survey Jackson County. Their locations are as follows:

A. Jackson Co. T14N R1W S4&8. Approx. 6.4 km NE of Swifton then 0.6 km E on section road. Trib. 12 Oct. 91.
B. Jackson Co. Same as above except Village Creek at mergence of above site. 12 and 19 Oct. 91 and 10 April 92.
C. Jackson Co. T13N R2W S26. Swan Pond Slough approx 0.8 km E of Tuckerman on St. Hwy. 37. 7 Dec. 91.

D. Jackson Co. T13N R1W S14. Two small lakes on Village Creek approx. 4.8 km NE of Swifton. 11 Jan. 92.

E. Jackson Co. T13N R1W S4. Holly Lake on Village Creek approx. 3.2 km SE of Swifton and approx. 0.4 km S of St. Hwy. 226. 31 Jan. 92, 1 Feb. 92 and 4, 5 and 6 Sept. 92.

F. Jackson Co. T12N R1W S7 and R2W S12. Tupelo Brake approx. 6.4 km S of Tuckerman. 29 Aug. 92.

Sites A, B (twice) and C were sampled with the previously described seines. Sites B and F were sampled by Turtox Indestructible™ dip net. Site D was sampled by gill net and Site E was sampled twice each by trammel net and hook and line.

All voucher specimens were fixed on site in a 10% formalin solution. After a period of not less than three days they were rinsed and placed in 40% isopropanol. All specimens are deposited in the Ichthyological Collection of the ASU Museum of Zoology. Some large fishes, after identification and enumeration, were released due to size.

Diversity indices were calculated using the Aquatic Ecology-PC program of Oakleaf Systems, Decorah, IA. Simpson Diversity Index corresponds to the number of randomly selected pairs of individuals that must be drawn from a community in order to have an even chance of obtaining a pair with both individuals of the same species. It expresses the dominance of or concentration of abundance into the one or two commonest species of the community (Poole, 1974). The base 2 logarithm was selected for calculating diversity indices, as it is the most commonly utilized log (Cox, 1985).

Results

A total of 8000 specimens was collected (16 families and 42 species). Of these, 7754 specimens were taken at seasonal sites (1-12), while 246 came from supplemental sites (A-F). The most abundant family was Centrachidae, while Poeciliidae, although represented by a single species (*Gambusia affinis*), was second numerically. Two species not previously known for the System were also collected. *Hiodon alosoides* was collected once, during the summer (Site 7), and *Pimephales vigilax* was collected during the summer (Sites 6 and 12), winter (Sites 4 and 6) and spring (Site 6). These records increase the number of species recorded for the Village Creek System to 62 (Table 1).

Table 1. Ichthyofauna of the Village Creek System.

	Scientific Name	Common Name
	Polyodon spathula (Walbaum)	paddlefish
	Atractosteus spatula (Lacepede)	alligator gar
*	*Lepisosteus oculatus* (Winchell)	spotted gar
	Lepisosteus osseus (Linnaues)	longnose gar
*	*Lepisosteus platostomus* Rafinesque	shortnose gar
*	*Amia calva* Linnaeus	bowfin
	Anguilla rostrata (Lesueur)	American eel
	Alosa chrysochloris (Rafinesque)	skipjack herring
*	*Dorosoma cepedianum* (Lesueur)	gizzard shad
***	*Hiodon alosoides*	goldeye
*	*Esox americanus* Gmelin	grass pickerel
	Esox niger Lesueur	chain pickerel
	Ctenopharyngodon idella (Valenciennes)	white amur
	Cyprinella venusta (Girard)	blacktail shiner
*	*Cyprinus carpio* Linnaues	common carp
*	*Hybognathus nuchalis* Agassiz	silvery minnow
*	*Lythrurus fumeus* Evermann	ribbon shiner
*	*Notemigonus crysoleucas* (Mitchell)	golden shiner
*	*Notropis atherinoides* Rafinesque	emerald shiner
	Notropis boops Gilbert	bigeye shiner
*	*Notropis maculatus* (Hay)	taillight shiner
*	*Notropis texanus* (Girard)	weed shiner
	Notropis umbratilis (Girard)	redfin shiner
	Notropis volucellus (Cope)	mimic shiner
*	*Opsopoeodus emilae* (Hay)	pugnose minnow
**	*Pimephales vigilax* (Baird and Girard)	bulhead minnow
*	*Ictiobus bubalus* (Rafinesque)	smallmouth buffalo
*	*Ictiobus cyprinellus* (Valenciennes)	bigmouth buffalo
*	*Ictobus niger* (Rafinesque)	black buffalo
*	*Minytrema melanops* (Rafinesque)	spotted sucker
	Moxostoma duquesnei (Lesueur)	black redhorse
*	*Ameiurus melas* (Rafinesque)	black bullhead
*	*Ameiurus natalis* (Lesueur)	yellow bullhead
	Ictalurus furcatus (Lesueur)	blue catfish
*	*Ictalurus punctatus* (Rafinesque)	channel catfish
*	*Noturus gyrinus* (Mitchell)	tadpole madtom
	Noturus nocturnus Jordan	freckled madtom
	Pylodictis olivaris (Rafinesque)	flathead catfish
*	*Aphredoderus sayanus* (Gilliams)	pirate perch
*	*Fundulus olivaceus* (Storer)	blackspotted topminnow
*	*Gambusia affinis* (Baird and Girard)	mosquitofish
*	*Labidesthes sicculus* (Cope)	brook silverside
	Morone chrysops (Rafinesque)	white bass
	Morone mississippiensis Jordan & Eigenmann	yellow bass
*	*Lepomis cyanellus* Rafinesque	green sunfish
*	*Lepomis gulosus* (Cuvier)	warmouth
*	*Lepomis humilus* (Girard)	orangespotted sunfish
*	*Lepomis macrochirus* Rafinesque	bluegill
*	*Lepomis megalotis* (Rafinesque)	longear sunfish
*	*Lepomis microlophus* (Gunther)	readear sunfish
*	*Lepomis punctatus* (Valenciennes)	spotted sunfish
*	*Micropterus punctulatus* (Rafinesque)	spotted bass
*	*Micropterus salmoides* (Lacepede)	largemouth bass
*	*Pomoxis annularis* Rafinesque	white crappie
*	*Pomoxis nigromaculatus* (Lesueur)	black crappie
*	*Elassoma zonatum* Jordan	banded pygmy sunfish
	Etheostoma asprigene (Forbes)	mud darter
	Etheostoma blennioides Rafinesque	greenside darter
*	*Ethesotoma chlorosomum* (Hay)	bluntnose darter
*	*Ethesotoma gracile* (Girard)	slough darter
	Etheostoma proeliare (Hay)	cypress darter
*	*Aplodinotus grunniens* Rafinesque	freshwater drum

* = collected in this study
** = collected in this study but first by Looney (unpubl.)
*** = collected in this study and new to the system

Most fishes were collected during the summer (31 species, 4601 specimens), while the fewest individuals were collected during the winter (18 species, 525 specimens). Fall (19 species, 1176 specimens) and spring (28 species, 1353 specimens) were intermediate in values. Both Simpson and Shannon-Wiener diversity index values reflected this pattern.

All 42 species collected in the study were taken in Jackson County, but only 24 of these species were recorded from Randolph and Lawrence counties (24 counting several dead freshwater drum at the St. Hwy. 90 fish kill). The four seasonal sites in Jackson County (6, 7, 11, 12) collectively yielded 38 species, while the eight sites (1-5, 8-10) in Randolph and Lawrence counties had but 23 species (Table 2). More specifically, the two main stem sites in Jackson County (6, 7) supported 55% more fish species than the main stem sites (2-5) in Randolph and Lawrence counties, and the two Jackson County tributary sites (11, 12) supported 47% more fish species than did the four tributary sites (1, 8-10) in Randolph and Lawrence counties (Table 3). When the results of the supplemental samples are included, the six main stem and four tributary sites in Jackson County collectively yielded 38 and 25 species, while the four main stem and four tributary sites in Randolph and Lawrence counties had but 20 and 17 species, respectively. Diversity index values were also greater in Jackson County (Table 3).

Fourteen species were collected only in Jackson County: *Lepisosteus osseus, Lepisosteus platostomus, Hiodon alosoides, Hybognathus nuchalis, Lythrurus fumeus, Notropis texanus, Minytrema melanops, Aphredoderus sayanus, Labidesthes sicculus, Lepomis humilus, Lepomis punctatus, Micropterus punctulatus, Elassoma zonatum* and *Etheostoma gracile*. Conversely, no species were found only in Randolph and/or Lawrence counties. However, the only freshwater drum recorded from Randolph and Lawrence counties were from the previously mentioned fish kill.

Discussion

Black (1940) reported 12 species from four sites in the Village Creek System, all of which are still fairly common. However, since Beadle's (1977) investigation there appears to have been a moderate decline in species diversity (Tables 4, 5). Most of the fish species reported by Beadles (1977) but not collected in this study (e.g. *Polyodon spathula, Atractosteus spatula*) are big river forms which periodically invade the lower Village Creek System from the White River. These species are least likely to be captured by methods used in this study. Nevertheless, in 1977 the most abundant fish species formed less than 50% of the total community, but they now account for over 70% of fishes collected. Further, panfishes have been displaced by the mosquitofish (Table 4). This species has broad ecological tolerances and, when introduced, almost always eliminates most or all of the smaller native fishes (Robison and Buchanan, 1988).

The effects of environmental degradation are further emphasized when the fish collections from Jackson County are compared with those from Randolph/Lawrence counties (Table 3). Despite the smaller sampling effort (two stations vs. five), by every measure utilized, the main stem stations in Jackson County have a more diverse, stable community structure. Comparisons of tributary stations yield similar results. All tributary stations have been channelized, but the two stations in Jackson County have more diverse assemblages because of their proximity to the unchannelized (in Jackson County) main stem.

Village Creek supports a diverse fish fauna, particularly for a deltaic stream. Mauney and Harp (1979) reported 42 and 32 species for Bayou DeView and Cache River, respectively. These streams are just to the east of and basically parallel Village Creek. Both streams, particularly Cache River, are also larger than Village Creek.

Several environmentally sensitive fish species still occur at least in limited numbers in this stream system. *Atractosteus spatula* and *Poloyodon spathula* are considered by Robison and Buchanan (1988) to be species of special concern. *Opsopoeodus emiliae, Elassoma zonatum, Etheostoma asprigene, Etheostoma chlorosomum, Etheostoma gracile* and *Etheostoma proeliare* are all declining in eastern Arkansas because environmental perturbation is decreasing the extent of their preferred habitat.

The Village Creek System in particular continues to be degraded today. Channelization is in progress as this paper is written. More natural cover (woodlots and fence rows) is being removed, with subsequent erosion of topsoil. Solid wastes, including agricultural chemical containers, are widespread and, at least locally, profuse. As recently as 1984 Victor Industries, Revere Copper Brass, AM Lantern, Diaz Refinery and the cities of Swifton, Tuckerman, Hoxie and Walnut Ridge had NPDES permits to dump various effluents into Village Creek and its tributaries (ADPCE, 1984). Precise impacts of these events are not yet clear.

This study clearly reveals that the Village Creek System harbors a diverse ichthyofauna, but that diversity is being eroded. If the environmental degradation is not reversed in the near future, the stream shall become like most other streams in the Mississippi Alluvial Plain, devoid of nearly all but the most tolerant species.

Table 2. Species Distribution within Seasonal Samples

Species	Sites												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Lepisosteus oculatus							4						4
Lepisosteus platostomus							2						2
Dorosoma cepedianum		26	63	4	8	33	11	414	32	5		9	605
Hiodon alosoides							1						1
Esox americanus										2			2
Cyprinus carpio	1		1					9					11
Hybognathus nuchalis						1	49					611	611
Notemigonus crysoleucas	7		1			3		3	2	2	131	18	167
Lythrurus fumeus												33	33
Notropis atherinodes				5			5	2		1		29	42
Notropis maculatus					2	13							15
Notropis texanus											5		5
Opsopoeodus emiliae					7	18	4				6		35
Pimephales vigilax				1		8						2	11
Ictiobus bubalus						2	4	2					8
Ictiobus niger		2	54				2						58
Minytrema melanops						1	3					3	7
Ameiurus melas	6							2	1		1	1	11
Ictalurus punctatus		30	2	7				1					40
Aphredoderus sayanus							1				1		2
Fundulus olivaceus					16	14	11				204	2	246
Gambusia affinis	942	29	361	1	57	10	33	180	303	105	202	132	2355
Labidesthes sicculus							4						4
Lepomis cyanellus	472	13	2	5	416	30		37	233	32	98	52	1390
Lepomis gulosus	3	1	1	1	5	2	5		10	1	22	7	58
Lepomis humilus							1						1
Lepomis macrochirus	12	79	31	10	117	68	23	533	150	13	170	151	1357
Lepomis megalotis		62	21	12	20	49	1	1	91	13	101	89	461
Lepomis microlophus							4		10				14
Lepomis punctatus						3							3
Micropterus punctulatus												1	1
Micropterus salmoides		1	1	3	4		1				1		11
Pomoxis annularis		9	6	2	11	3	6	23		3	14		77
Pomoxis nigromaculatus	2					2	4	3			2	2	15
Elassoma zonatum							1						1
Etheostoma chlorosomum			1	2	9	6	1		1	4	5	4	33
Etheostoma gracile						1	1				4		6
Aplodinotus grunniens						1							1
Notropis sp.							6						6
Total	1443	254	545	54	672	269	183	1210	833	181	962	1149	7754

Table 3. Comparison of Seasonal Sites in Jackson County vs. Non-Jackson County

	Main Stem		Tributaries	
	Jack.	Rand./Law.	Jack.	Rand./Law.
Total No. Taxa	31	20	23	17
Mean No. Taxa	22	12	16	11
Mean No. Ind.	226	382	1056	917
Mean Simp. Div.	0.866	0.699	0.759	0.627
Mean Shan. Div.	3.430	2.354	2.590	1.736
Mean Hmax'	4.417	3.612	4.043	3.165

Table 4. Dominant Fish Species (%).

Beadles (1977)	Looney (unpub)*	This Study
Lepomis macrochirus (15)	*Gambusia affinis* (70)	*Gambusia affinis* (29)
Lepomis cyanellus (13)	*Lepomis macrochirus* (12)	*Lepomis cyanellus* (17)
Notropis texanus (11)	*Etheostoma chlorosomum* (3)	*Lepomis macrochirus* (17)
Gambusia affinis (10)		*Hybognathus nuchalis* (8)

*Collections were made during October 1988 and January 1989.

Table 5. Comparative H' values.

Station-Season	Beadles (1977)	Looney (unpub)	This Study
1-winter	1.831	1.023	
4-summer	2.681	–	2.000
4-fall	1.712	2.873	–
4-winter	2.226	2.658	2.873
6-summer	3.542	–	2.817
6-fall	3.011	2.442	2.930
6-winter	2.540	–	2.232
7-summer	3.506	–	3.285

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